

The TelePresence Microscopy Collaboratory

When the 6th grade students at St. Dominic Grammar School dismantled several obsolete PC's to "see what was inside," that normally would have signaled the end of the lesson. However, the TelePresence Microscopy Collaboratory allowed them to go even further. Over the Internet, they used an electron microscope to examine a computer chip and discuss their observations with scientists at remote locations.

The TelePresence Microscopy (TPM) Collaboratory at Argonne National Laboratory is an online "electronic space" that integrates computing technology with state-of-the-art scientific instruments. With a web browser, a personal computer, and an Internet connection, researchers and students at remote locations can interact with each other as they operate, control, and use scientific instruments for research or education.

The TPM facility currently employs electron microscopes as part of its shared scientific instrumentation; however, the technology and software used here can be extended to a diverse range of scientific instruments.

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Introduction

Collaboration between individuals or teams is one of the mechanisms today by which we advance our way of life. By sharing combined resources - expertise, knowledge, instruments, and data - we are generally able to solve problems, conduct research and educate the next generation faster, better and/or at lower overall cost than when an individual attacks the same problem.

Technology today can, of course, be utilized to enhance this process. For example, the telephone has for decades allowed us to communicate with individuals over distances to share ideas verbally. Videophones, which were developed over 30 years ago as a novel demonstration, have now reached the commercial market place at an affordable price level and the technology employed over the Internet (E-mail, WWW, and FTP) has allowed us to share text and images rapidly and efficiently.

However, each of these methodologies has only begun to scratch the surface or reach the level of interactive cooperation that is needed to achieve a new paradigm in how we will work, conduct scientific research or educate students in the future. In order to accomplish our goals we need a new set of tools, protocols and philosophies for sharing resources, which allows us to transcend the limits of time and geographic distance.

This paradigm, TelePresence Collaboration, must allow us to utilize and experience the entire set of resources both locally and remotely regardless of one's location - be it in the office, the laboratory or in the classroom. Ultimately, it must provide an environment, which is as rich in content and experience so as to make the remote user feel as if they were

physically sitting next to their colleague.

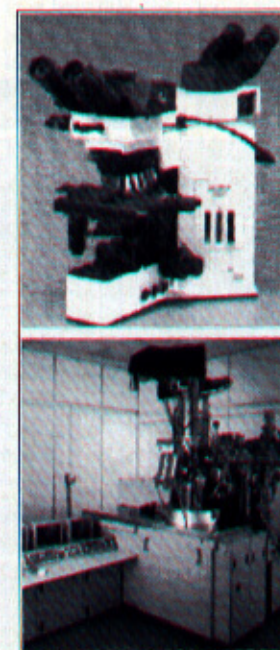
The TelePresence Microscopy Collaboratory 1-2 (TPM) at Argonne National Laboratory (ANL) is one of many approaches, which is attempting to address this goal.

The Collaboration: A Persistent Electronic Space

The TPM Collaboratory [<http://tpm.amc.anl.gov>] is a prototype virtual electronic laboratory in which state-of-the-art instrumentation and expertise is being used for fundamental science research and to test and develop new ways of remotely sharing resources with research, industrial and academic communities.

Microscopy, in general, is a visually rich technique, and its tools vary widely from the simple Optical Microscope, which can cost less than a hundred dollars; to the Advanced Analytical Electron Microscope used at ANL, which would cost in excess of several million dollars to replicate (Figure 1).

Figure 1



Tabletop optical microscope (height ~0.3 meters) compared to the ANL Advanced Analytical Electron Microscope (height ~ 3.0 meters).